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Commercial Uses
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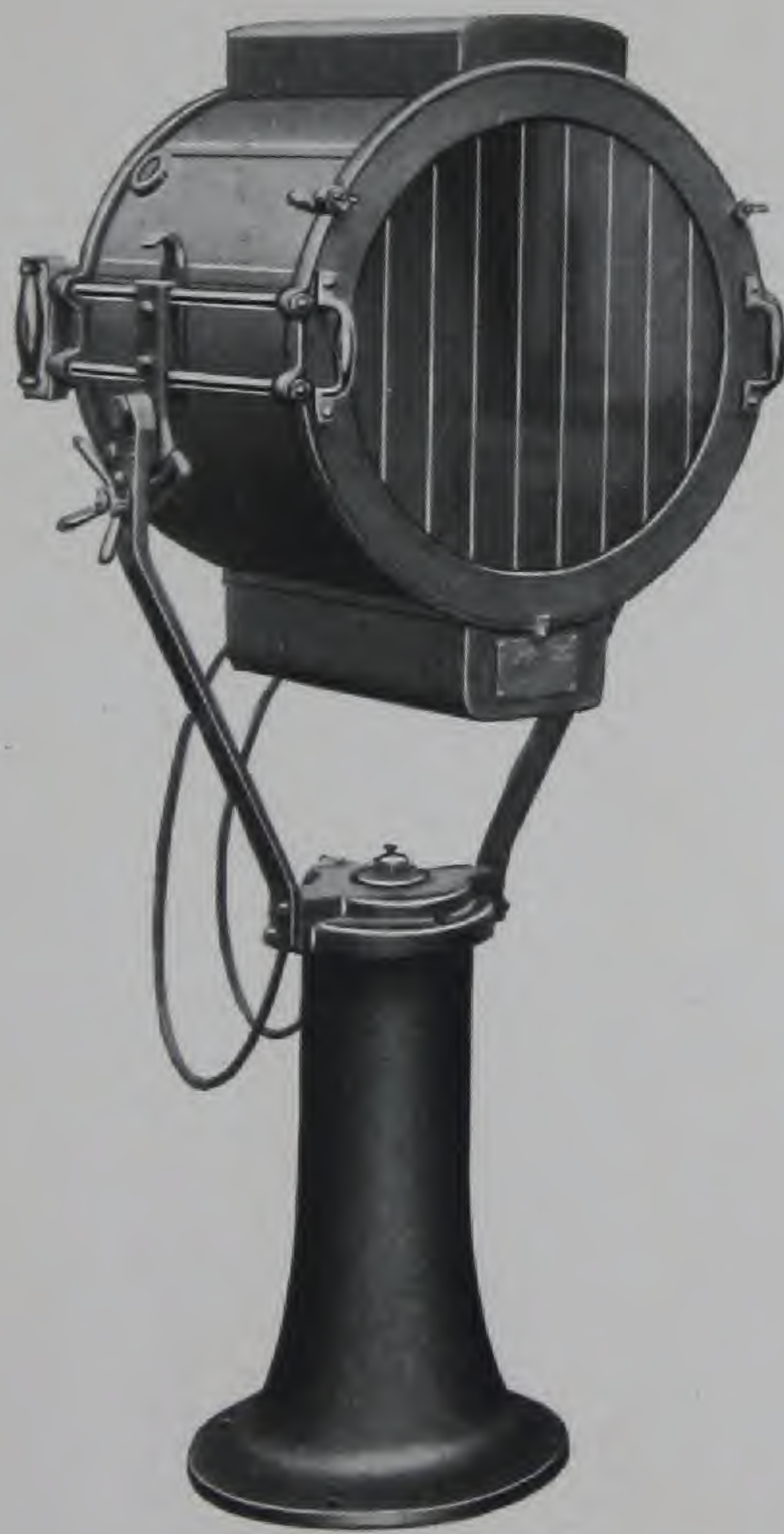
CHAS. H. HARRIS
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1914



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Commercial Uses for Searchlights

BRANLON
1851
LONDON



GENERAL ELECTRIC COMPANY
SCHENECTADY, NEW YORK

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Class 49

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***F**IRELESS fire works—The effect is produced by smoke, steam and explosive bombs lighted by 36-inch and 30-inch G-E Searchlights. The color effects are obtained by screens in front of the searchlights.*

Commercial Uses for Searchlights



PALACE OF FINE ARTS AT THE INTERNATIONAL EXPOSITION IN SAN FRANCISCO IN 1915. IT AFFORDS A BEAUTIFUL EXAMPLE OF LIGHTING BY MEANS OF SEARCHLIGHTS OF WHICH 18 OF THE 18-INCH SIZE WERE USED

Commercial Uses for Searchlights

THE accompanying illustrations show the wide field of application of searchlights to commercial use, ranging from the artistic illumination of the towers and domes of an International Exposition and the display of color and life on a Jeweled Portal of Victory, to the effective lighting of yards and buildings in a manufacturing plant, as an assistance to patrol work.

The illustration on the cover is a photograph of the Tower of Jewels at the Panama Exposition in 1915. The illumination of the Tower, which was 435 feet high and covered with over 100,000 Novagem Jewels, was effected by the use of twenty of the 18-in. size General Electric searchlights with a secondary illumination of the shadows by rose red incandescent lamps. The reflection of the Tower in the lagoon is so well defined that it is difficult to distinguish the Tower from its reflection.

Commercial Uses for Searchlights



THE JEWELLED PORTAL ERECTED IN NEW YORK CITY IN HONOR OF THE RETURNING TWENTY-SEVENTH DIVISION, U. S. ARMY, MARCH, 1919. THE PORTAL CONSISTED OF TWO OBELISKS EIGHTY FEET HIGH, FLANKED BY TWO ALTARS, TWENTY-SIX FEET HIGH, BETWEEN WHICH WERE SUSPENDED CURTAINS OF JEWELS WHICH FLASHED BACK, AT THOUSANDS OF POINTS, THE LIGHT FROM THE SEARCHLIGHTS, BREAKING IT UP INTO THE TRUE COLORS OF THE SPECTRUM

The General Electric Company manufactures a complete line of direct current arc searchlights in the following sizes and types of control:

- 9-in. hand, pilot house, rope and shaft controls,
- 13-in. hand, pilot house, rope, shaft, and electric controls,
- 18-in. hand, pilot house, rope, shaft, and electric controls,
- 24-in. hand, shaft and electric controls,
- 30-in. hand, shaft and electric controls,
- 36-in. hand, shaft and electric controls,
- 60-in. hand and electric controls.

All General Electric arc searchlights are equipped with silvered glass mirrors, the 9-in. and 13-in. sizes having Mangin mirrors, while the 18-in. and larger sizes have parabolic mirrors. The difference between these mirrors is described on page 7.

Commercial Uses for Searchlights

These searchlights are manufactured in the Schenectady factory, the material and workmanship being the best obtainable. All parts are made to gauge and are interchangeable to facilitate the repair of searchlights. Each searchlight is thoroughly inspected and tested before leaving the factory. The standard finish of all exposed parts is dull black, but other finishes, such as polished brass or slate gray, can be supplied upon special order. The standard searchlights are constructed principally of steel and iron, but non-magnetic material can be supplied throughout on special orders when it is required to install the searchlight near a compass.

STANDARD EQUIPMENT

The standard equipment of a searchlight outfit is as follows:

- Searchlight with lamp, mirror and plane front door strips,
- Rheostat,
- Box containing tools and spare parts,
- 25 pairs of carbons.

Canvas covers to protect the searchlight can also be supplied, but are not included in a standard equipment.



G-E SEARCHLIGHT USED IN NIGHT YARD PATROLS IN A LARGE MANUFACTURING PLANT. THE OPERATOR IS STATIONED INSIDE THE TOWER WHERE HE IS PROTECTED FROM THE WEATHER AND OPERATES THE SEARCHLIGHT BY MEANS OF HANDWHEELS. A TELEPHONE IN THE TOWER ENABLES THE OPERATOR TO DIRECT THE SEARCHLIGHT TO ANY POINT REQUESTED BY THE PATROLMEN

Commercial Uses for Searchlights

LAMP

The lamps of the commercial searchlights as shown on page 11, are of the horizontal type similar to those used in the low intensity Navy standard searchlights. They are entirely automatic, requiring the minimum of attention and are very quiet in operation. The lamps are single feed having a starting magnet to strike the arc; a feeding magnet to feed the carbons together; feed screws geared together and horizontal sliding carriages which support the clamps for the carbons. The clamp for the positive carbon is adjustable in two planes for centering the carbon in the focus of the mirror. The frame of the lamp is of composition metal and on account of its strength provides a rigid base for the moving parts of the lamp. A sheet metal cover protects the moving parts of the lamp from carbon dust. The lamp is readily removable from the barrel, electrical connections being made by means of contact shoes. It is not necessary to use tools to remove the lamp.



G-E 18-IN. SEARCHLIGHT MOUNTED ON TOWER FOR THE ILLUMINATION OF RAILROAD TRACKS. ALSO HAND CONTROLLED IN THE TOWER AND CONNECTED BY TELEPHONE WITH THE PATROLMEN IN THE YARDS

Commercial Uses for Searchlights



A FACTORY BUILDING ILLUMINATED BY G-E SEARCHLIGHTS AT A DISTANCE OF 600 FEET.
THE PHOTOGRAPH WAS EXPOSED FOR NINE MINUTES

MIRRORS

The Mangin mirror supplied with the 9-in. and 13-in. sizes is of glass, ground, polished and heavily silvered. The mirror is formed by the surfaces of the two eccentric spheres of different radii, so proportioned that the reflection and refraction of the glass will project the rays of light in a parallel beam, when the crater of the positive carbon is in the focus of the mirror.

The parabolic mirrors are of glass, ground, polished and heavily silvered. The reflecting surface is a parabola and the glass is of uniform thickness.

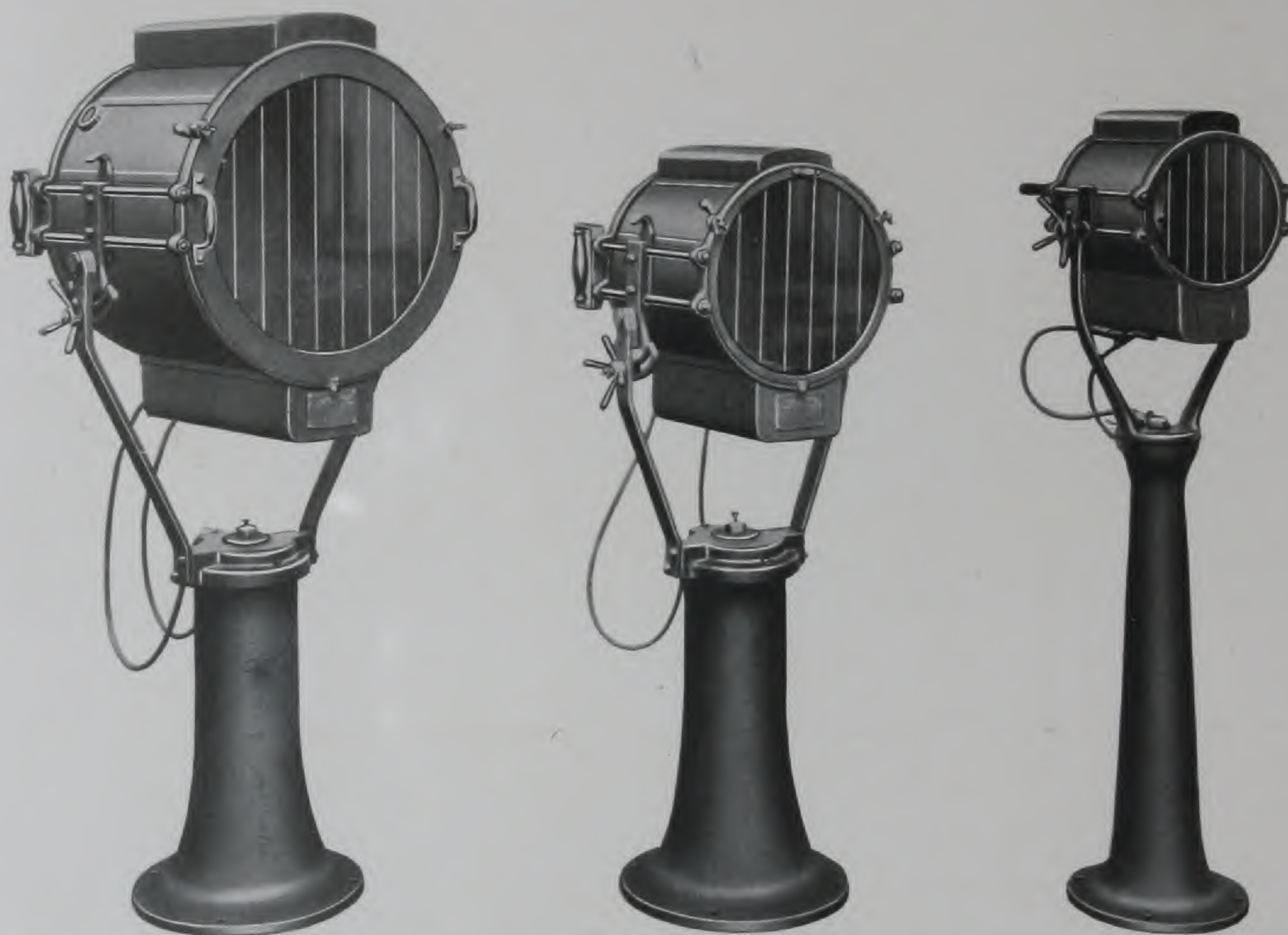
To allow for expansion due to heat and to prevent injury from concussion, the mirror is flexibly mounted in a metal ring and is protected from mechanical injury by a sheet metal dome. The dome and mirror ring are so constructed that they can be readily removed from the barrel.

FRONT DOOR

The front door of the barrel consists of strips of plate glass mounted in a metal ring. The whole door is readily removable from the drum without the use of tools. If it is

Commercial Uses for Searchlights

desired to illuminate a larger area, at some sacrifice of the intensity of light, a diverging door can be furnished, made of strips of glass ground plano-convex, each strip being a lens with the convex side outward. Such doors, interchangeable with the standard door, for spreading the beam horizontally to angles of 10, 20 and 40 degrees, can be supplied for any size projector. Orders for diverging doors should state the divergency wanted and whether the door is required in addition to the standard door, or to be used in its place.



18-IN., 13-IN. AND 9-IN. HAND CONTROL G-E SEARCHLIGHTS

TOOL BOX

The following tools and spares are provided in a hard wood box:

- Observing screen of colored glass,
- Wrench for carbon clamp,
- Socket wrench for adjusting lamp in the focus of the mirror,
- Wrench for small nuts,
- Chamois skin,
- Dust brushes,
- One set of springs and contacts for the lamp.

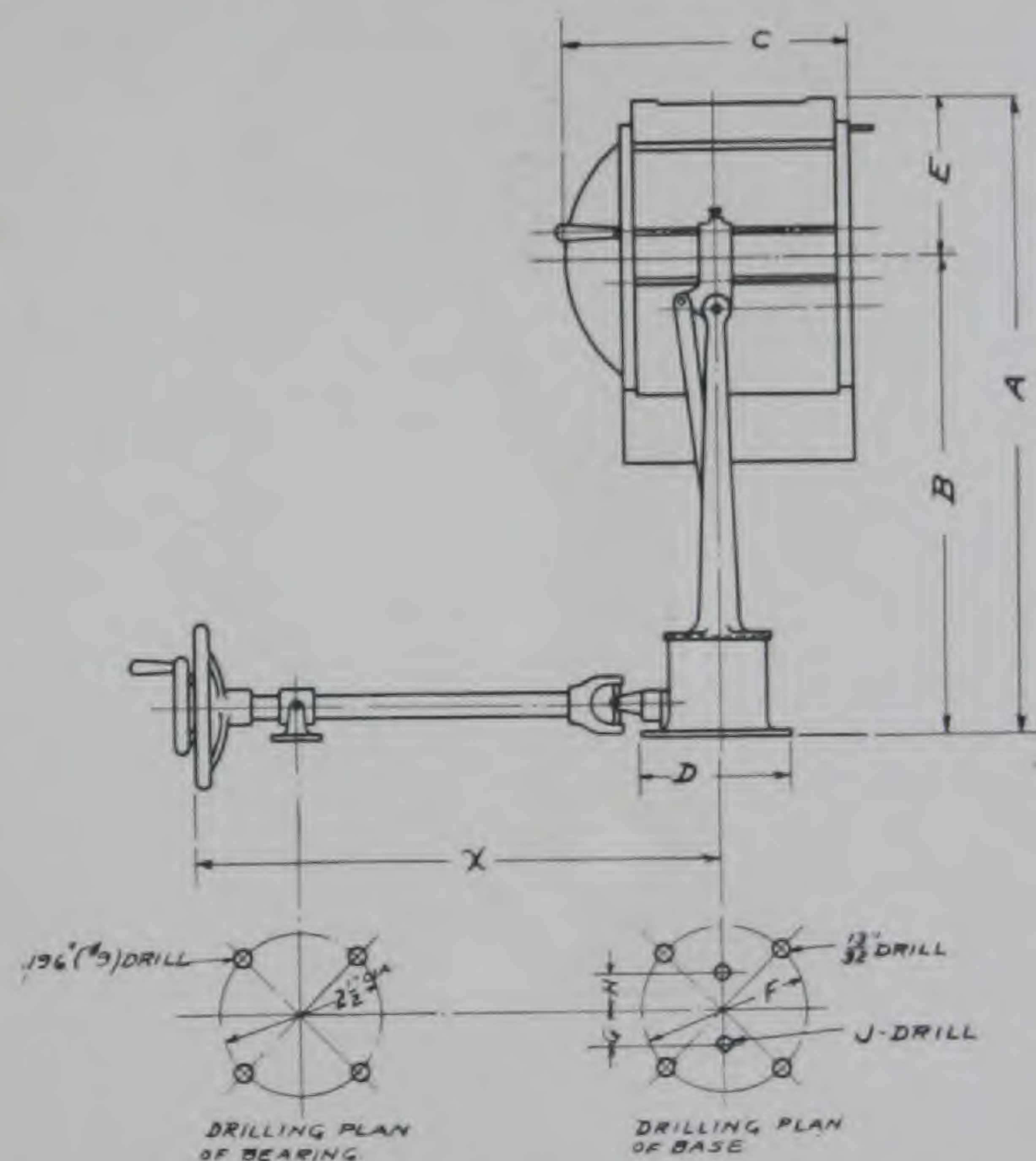
Commercial Uses for Searchlights

RHEOSTAT

The rheostat illustrated on page 14 is built up of resistance tubes and provided with an 8-point switch to adjust the current taken by the lamp. Taps are provided for line voltages of 110 to 125 volts. The 8-point switch is usually permanently fixed at the time the projector is installed, but can be used at any time to adjust the current to its proper value if the voltage varies or is changed for any reason. For circuits of higher potential than 125 volts, special large rheostats with cutout for protecting the feeding magnet of the lamp can be furnished, but these are wasteful of energy and are not recommended.



AN 18-IN. G-E PILOT-HOUSE CONTROL SEARCHLIGHT WITH SPECIAL REINFORCED FRONT DOOR. THIS TYPE WAS ADOPTED BY THE U. S. SHIPPING BOARD EMERGENCY FLEET CORPORATION FOR INSTALLATION ON CARGO SHIPS



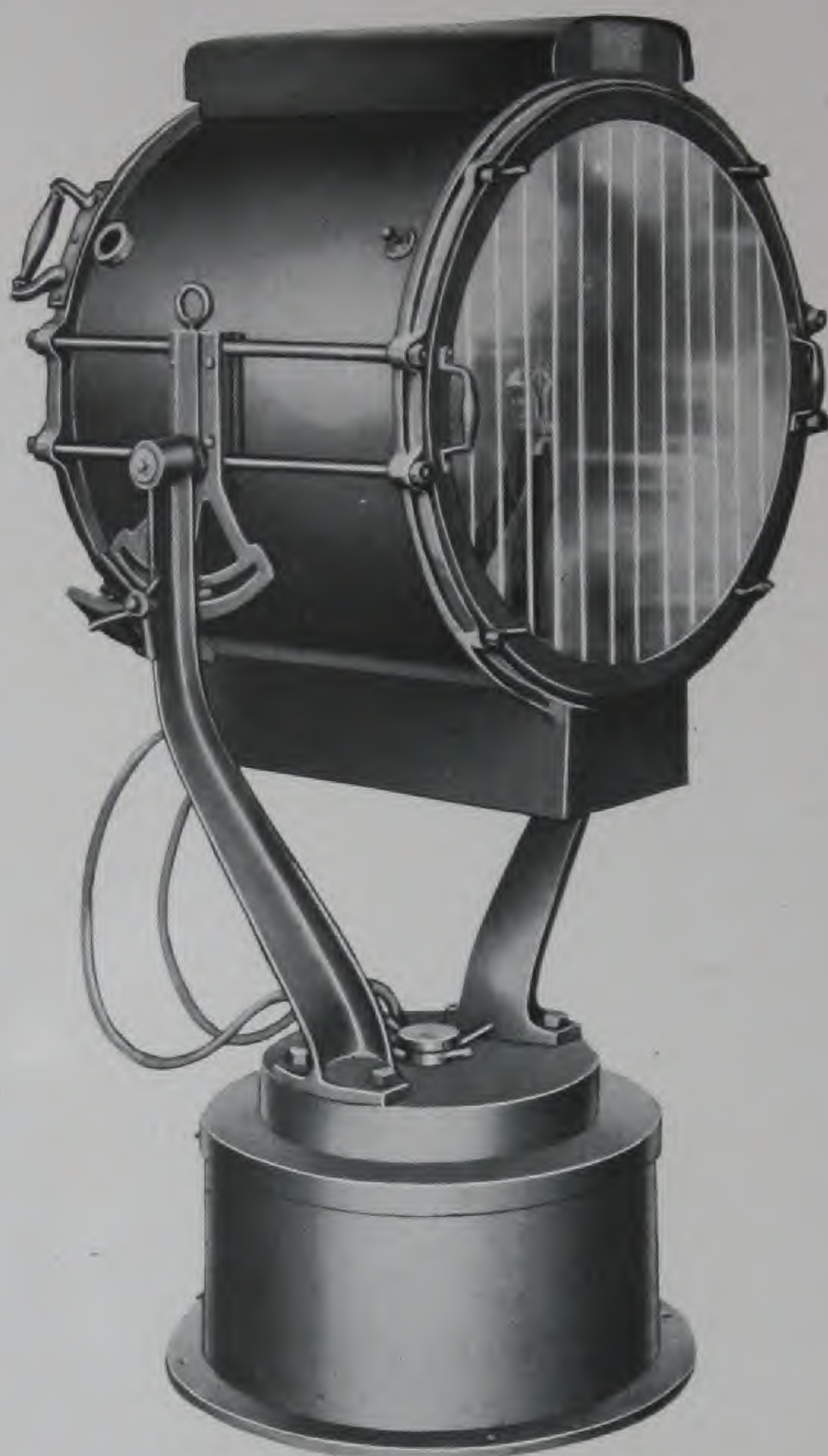
SHAFT CONTROL SEARCHLIGHT

SHAFT CONTROL SEARCHLIGHT

Class in In.	DIMENSIONS IN INCHES										Net Wt.*
	A	B	C	D	E	F	G	H	J	X	
9	23 $\frac{5}{32}$	16 $\frac{21}{32}$	15 $\frac{29}{32}$	7 $\frac{5}{8}$	6 $\frac{1}{2}$	7	1 $\frac{3}{4}$	1 $\frac{3}{4}$	To suit diam. of cable bushings	To suit customer's require- ments	130
13	32 $\frac{3}{8}$	23 $\frac{1}{8}$	18 $\frac{13}{16}$	9 $\frac{1}{8}$	8 $\frac{1}{2}$	8 $\frac{1}{4}$	2 $\frac{1}{2}$	2 $\frac{1}{2}$			190
18	41 $\frac{7}{16}$	28 $\frac{1}{16}$	25 $\frac{1}{2}$	9 $\frac{1}{8}$	13 $\frac{3}{8}$	8 $\frac{1}{4}$	2 $\frac{1}{2}$	2 $\frac{1}{2}$			329

* Standard equipment including tool box, rheostat and 25 pairs of carbons.

Commercial Uses for Searchlights



A 24-IN. HAND CONTROL G-E SEARCHLIGHT

CARBONS

The following table shows the standard sizes of carbons and the length of burning:

Size	DIMENSIONS IN INCHES		Length of Burning in Hours
	Pos. Carbon	Neg. Carbon	
9	$\frac{1}{2}$ by $5\frac{1}{2}$	$\frac{7}{16}$ by $3\frac{1}{2}$	$3\frac{1}{2}$ to 4
13	$\frac{5}{8}$ by 6	$\frac{1}{2}$ by $4\frac{1}{2}$	$3\frac{1}{2}$ to 4
18	$\frac{13}{16}$ by $8\frac{1}{2}$	$\frac{5}{8}$ by 5	4 to $4\frac{1}{2}$
24	1 by 12	$\frac{3}{4}$ by 7	5 to 6
30	$1\frac{1}{8}$ by 12	$\frac{7}{8}$ by 7	5 to 6
36	$1\frac{1}{4}$ by 12	1 by 7	$5\frac{1}{2}$

Commercial Uses for Searchlights

Types of Control

HAND CONTROL

The searchlights are trained in the vertical and horizontal planes by means of wooden handles attached to the rear of the barrel. Starwheels are provided to clamp the searchlight in any desired position.

PILOT HOUSE CONTROL

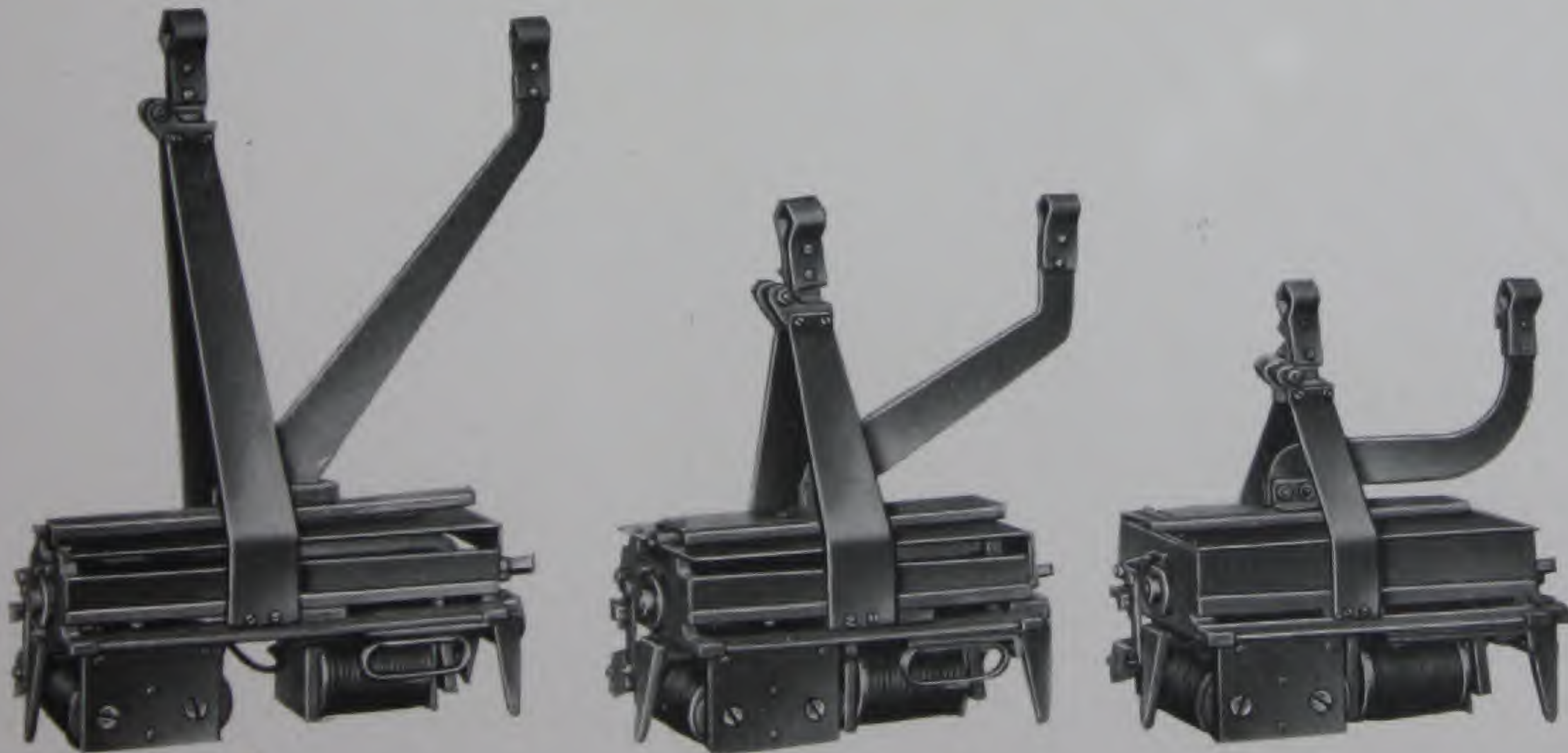
The pilot house control searchlights are trained by means of a single lever and handle. The manipulating gear which extends below the base of the searchlight is of brass, polished and lacquered. The rod for vertical training elevates or depresses the barrel by means of two connecting rods, one on each side of the barrel and attached to the trunnion plates.

ROPE CONTROL

The rope control searchlights are also trained by means of a single lever, the manipulating gear being connected to the searchlight by means of phosphor bronze tiller rope. All parts of the operating gear are below the base of the searchlight.

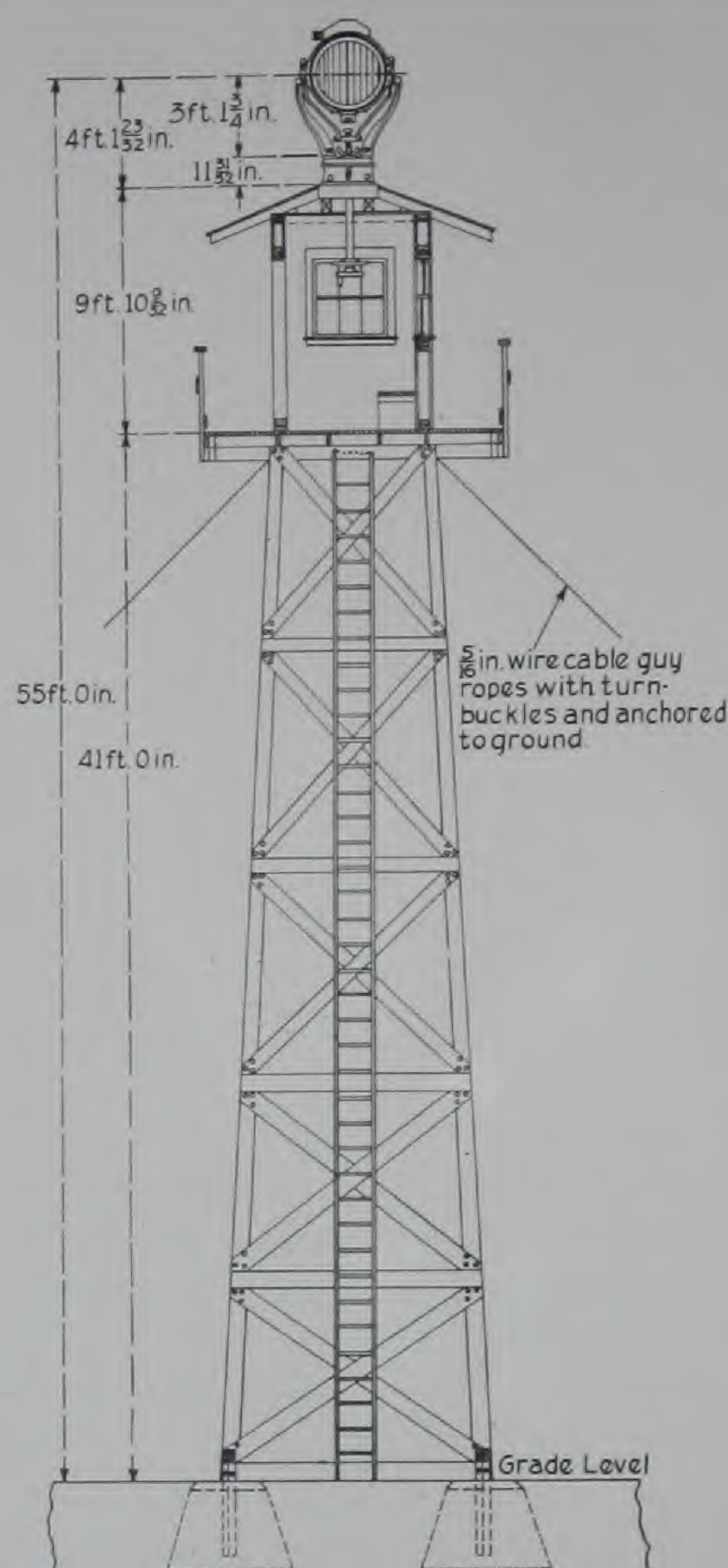
SHAFT CONTROL

The shaft control searchlights are trained by means of two concentric handwheels connected by means of shafts and universal couplings to bevel gears in the base of the searchlight. These gears mesh with other bevel gears attached to the turntable and the vertical training shaft. Two revolutions of the horizontal training handwheel revolve the search-



18-IN., 13-IN., AND 9-IN. G-E COMMERCIAL SEARCHLIGHT LAMPS

Commercial Uses for Searchlights



A TOWER ON WHICH A G-E SEARCHLIGHT WAS USED TO PROTECT EXPLOSIVE PLANT. ACCESS TO THE SEARCHLIGHT IS THROUGH A HATCH IN THE EAVES OF THE ROOF

light once. The handwheel, shafting, etc., are above the surface on which the base of the searchlight is mounted.

ELECTRIC CONTROL

A more expensive, but more satisfactory form of distant control is provided in the electric control searchlight, in which the training is accomplished by two motors mounted in the base and electrically connected to a small controller, which is so wired that the searchlight beam follows the movement of its handle in any direction.

This system requires less attention and is easier to operate than the rope control and has the great advantage over the latter that the controller wiring may be run by the most convenient route without regard to obstructions or changes of direction, which form serious difficulties in the other systems.

CURRENT AND VOLTAGE

The accompanying table shows the ranges in current and line voltage for which these searchlights can be adapted.

For the same current it is recommended that the larger searchlights be selected, as the illumination of the beam will be greater with the larger diameter of mirror. For example, it is preferable, when the available current is limited to 10 amperes, to install a 13-inch searchlight operating at 10 amperes rather than a 9-inch with the same current.

Size in Inches	CURRENT		VOLTAGE	
	Special Rating	Standard	Arc	Line
9	5-7.5	10	43-46	65-125
13	10-15	20	45-48	70-125
18	20-27.5	35	47-50	75-125
24	35-42.5	50	48-50	80-125

ILLUMINATION

Recently the General Electric Company has conducted photometric tests to measure the actual illumination of various sizes of commercial projectors in order that customers may gain knowledge as to the relative illumination of each size to aid them in selecting the searchlight suitable for their conditions.

Commercial Uses for Searchlights

The customary method of testing searchlights, by picking up an object at various distances, does not convey any accurate idea as to the illumination of the searchlight as the distance depends upon the color of the object, the condition of the atmosphere, and the personal equation of the observer's sight. The photometric measurements as given in the accompanying table are undoubtedly less than the actual illumination of the searchlight, as, on account of locating the photometer at a remote point, the measurements are affected by the absorption due to the amount of smoke generally found in the neighborhood of manufacturing establishments.

The following table gives averages taken from a large number of readings, of the illumination of the various sizes:

Size	Amp.	VOLTS		Mirror	Illumination in Candle Power
		Line	Arc		
9	10	110-125	45	Mangin	1,500,000
13	20	110-125	45	Mangin	4,500,000
18	35	110-125	45	Parabolic	8,000,000
24	50	110-125	48	Parabolic	18,000,000
30	80	110-125	50	Parabolic	30,000,000
36	110	110-125	60	Parabolic	50,000,000

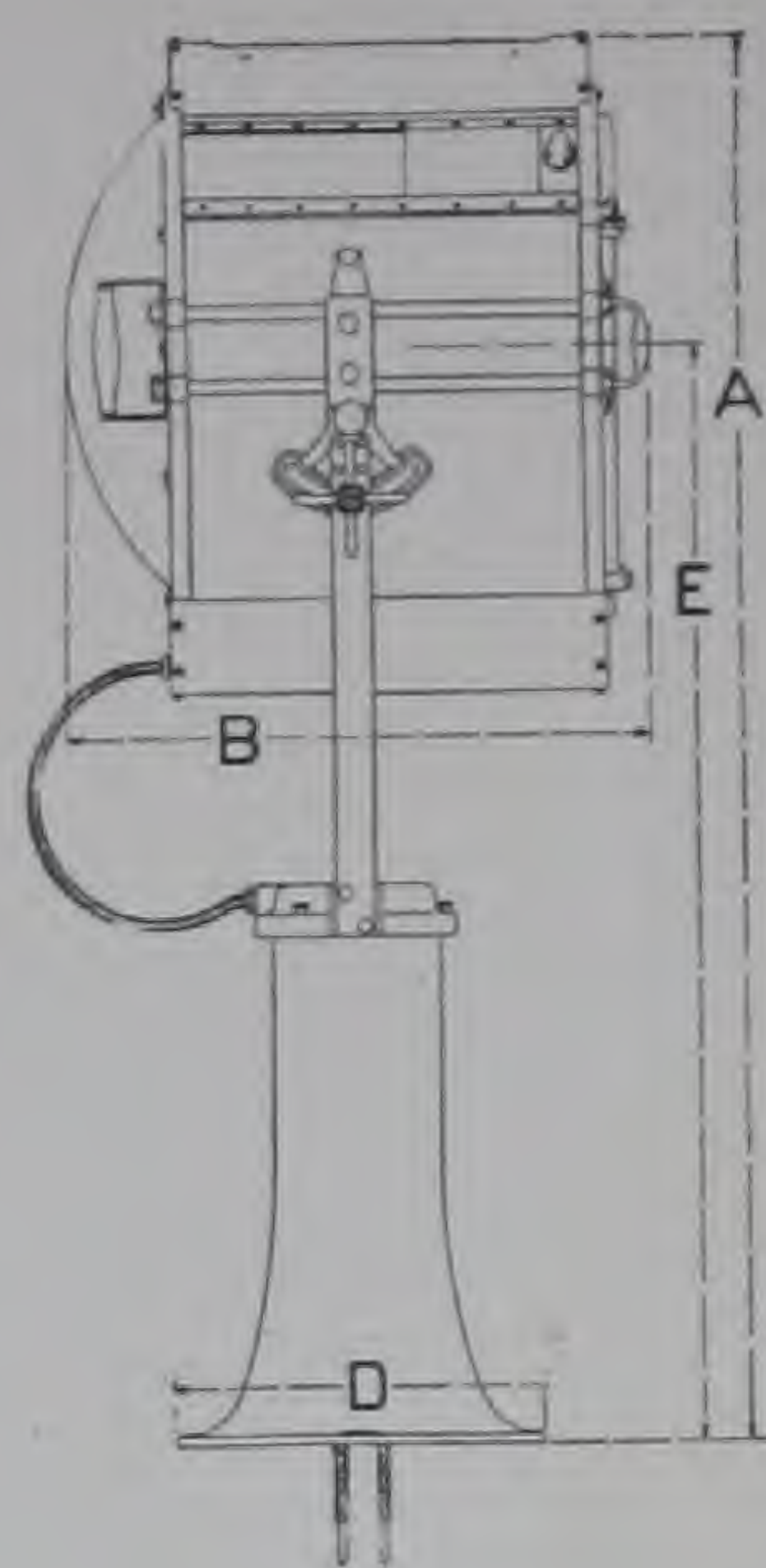
The above are the actual measurements reduced by the inverse square law to the illumination at the front door of the searchlight.

To obtain the illumination to be expected at any distance these figures should be divided by the square of the distance, in feet, to the object and as a rough allowance for atmospheric absorption under normal conditions 10 per cent per 1000 yards may be taken.

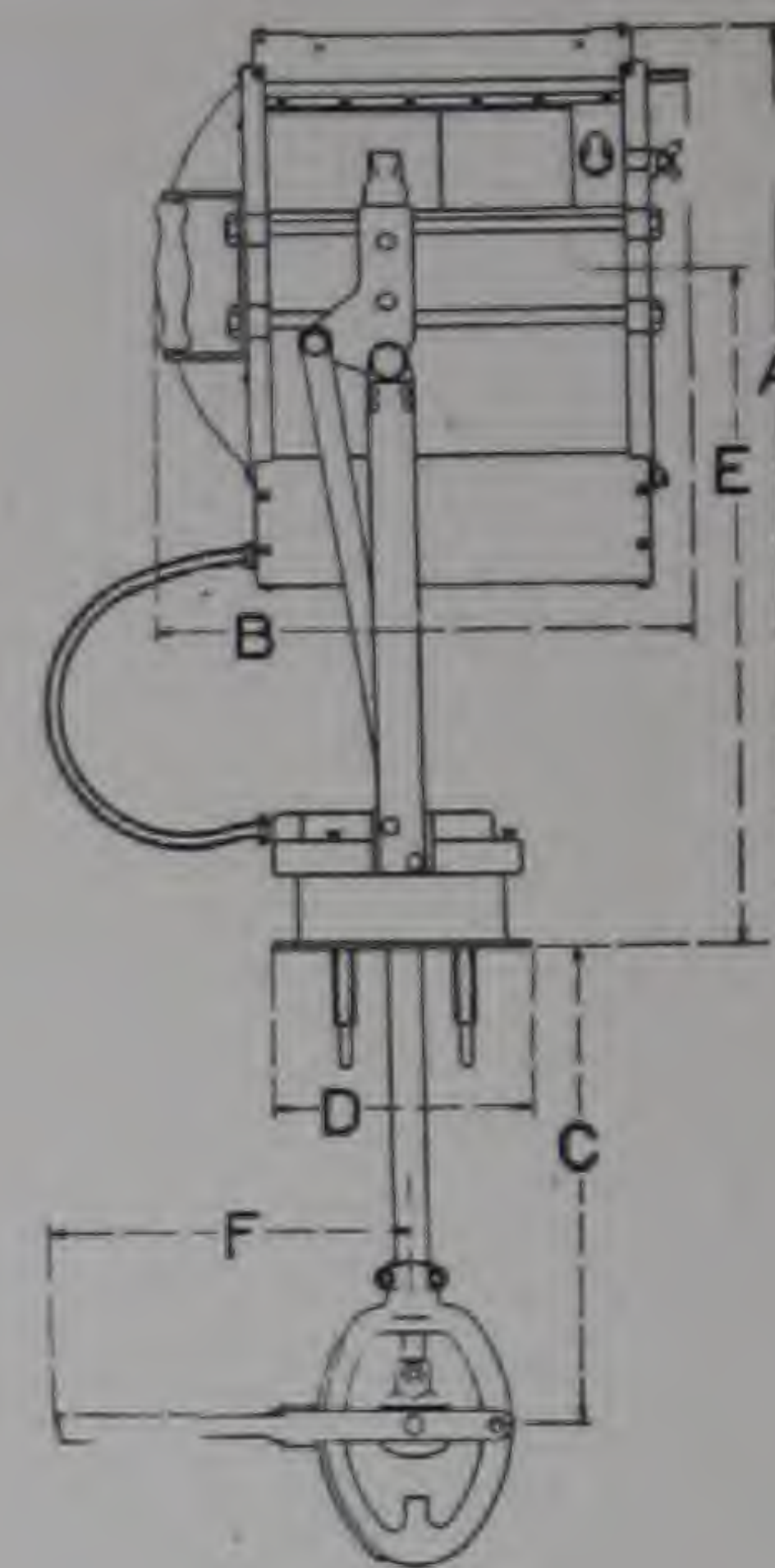
It will be noted that the above figures give the illumination in beam candle power at the front door of the searchlight. This should be distinguished from measurements of open arc illumination. The beam candle power takes into account the character of the reflecting mirror, and the brilliancy of the crater in the positive carbon as well as the quality of the glass in the front door and is a direct measure of the effective illumination provided by the searchlight.

In addition to the searchlights described above for commercial uses, the General Electric Company also manufactures, high intensity searchlights for military purposes, illustrations of which are given on page 15.

Commercial Uses for Searchlights

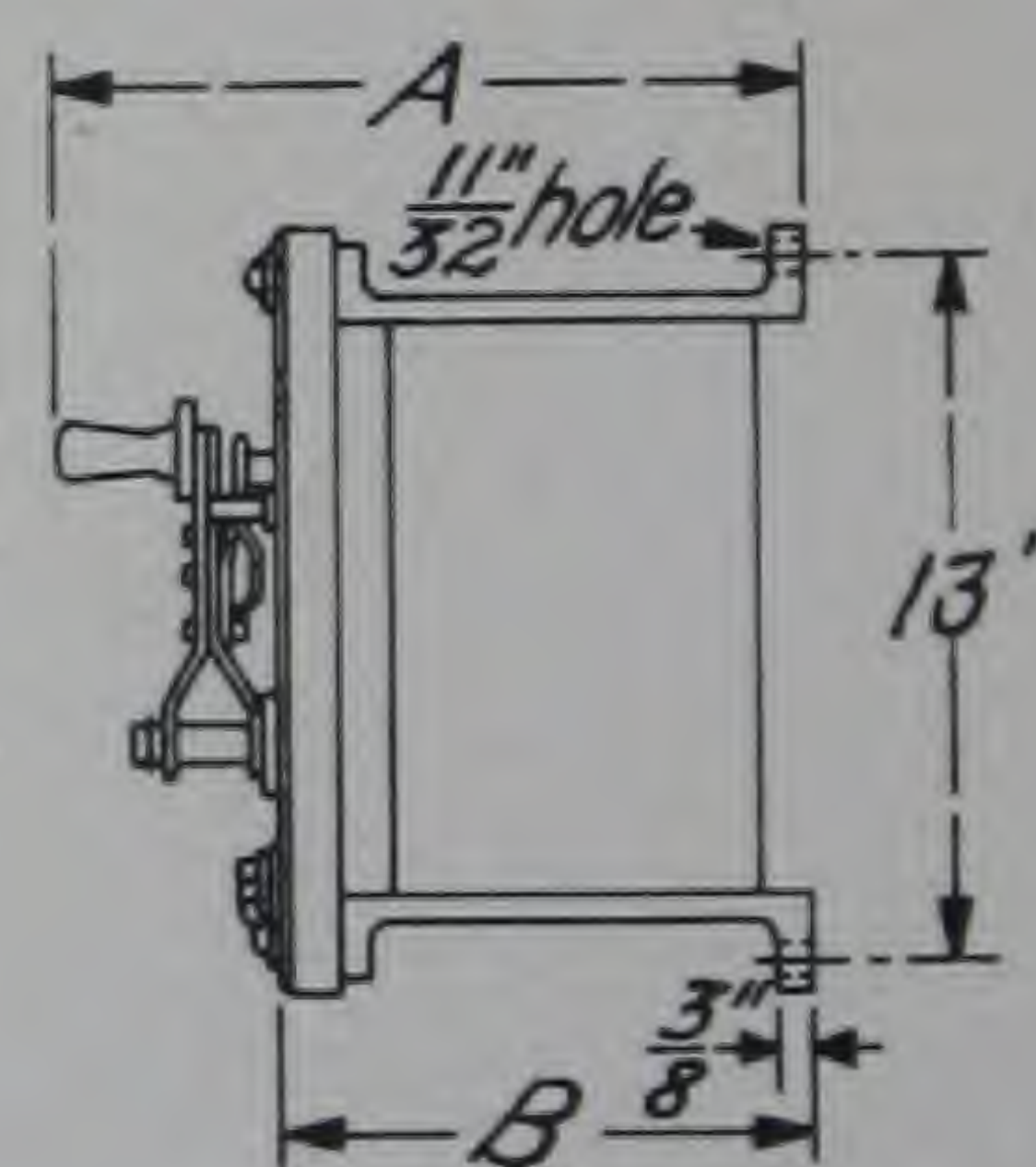
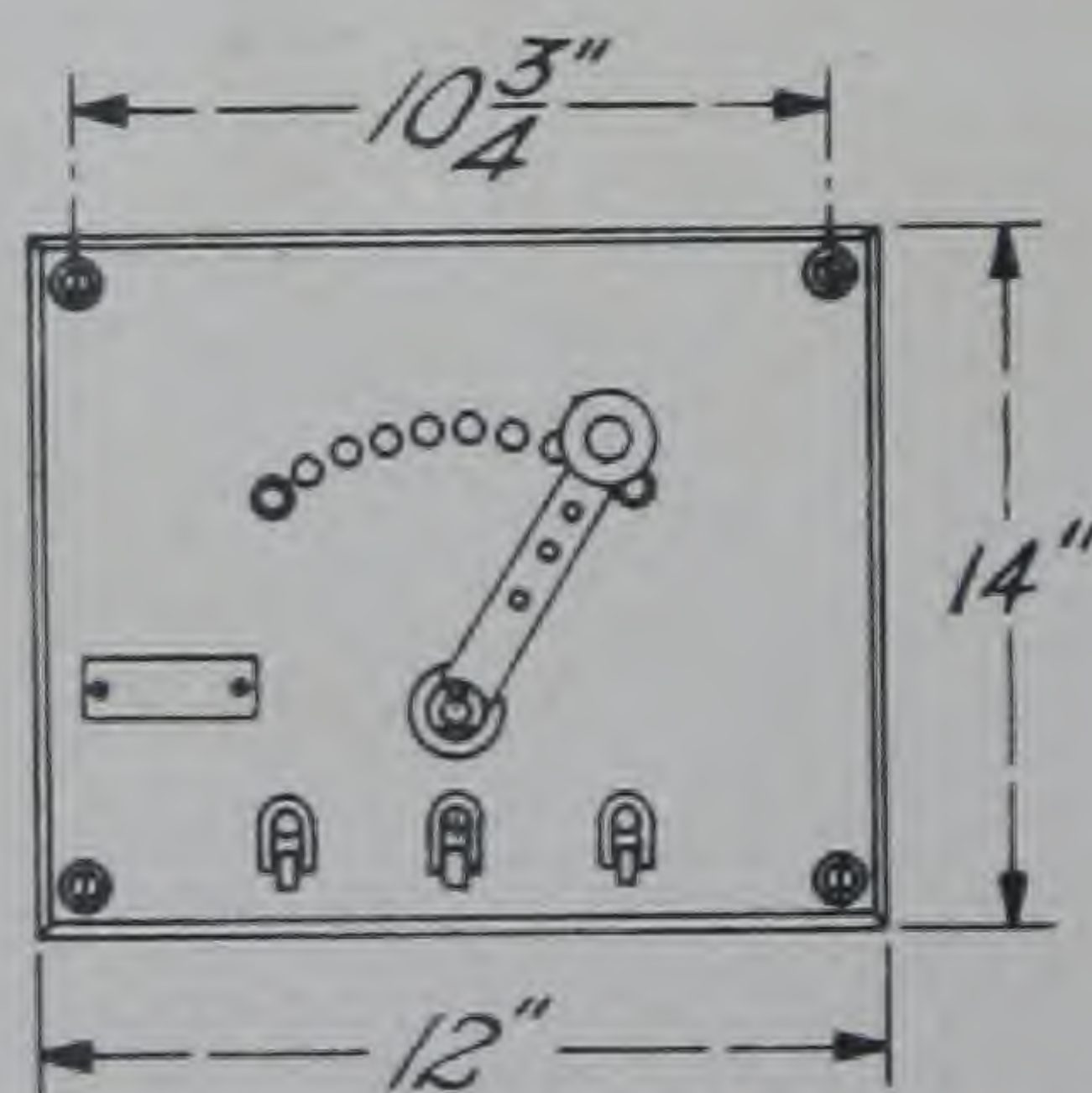


HAND CONTROL



PILOT HOUSE CONTROL

Size in In.	DIMENSIONS IN INCHES				Net Wt.†	Size in In.	DIMENSIONS IN INCHES						Net Wt.†
	A	B	D	E			A	B	C	D	E	F	
9	53 ¹³ / ₁₆	15 ²⁹ / ₃₂	12	47 ⁵ / ₁₆	134	9	25 ⁵ / ₃₂	15 ²⁹ / ₃₂	22	7 ⁵ / ₈	16 ²¹ / ₃₂	8 ²¹ / ₃₂	106
13	*51 ⁷ / ₁₆	18 ¹³ / ₁₆	16	42 ¹⁵ / ₁₆	207	13	32 ³ / ₈	18 ¹³ / ₁₆	22	9 ¹ / ₈	23 ⁷ / ₈	12 ⁷ / ₃₂	177
18	*60 ⁹ / ₁₆	25 ¹ / ₂	16	47 ³ / ₁₆	291	18	41 ⁷ / ₁₆	25 ¹ / ₂	22	9 ¹ / ₈	28 ¹ / ₁₆	12 ⁷ / ₃₂	274
24	63 ³ / ₄	30 ⁵ / ₈	25	46 ³ / ₈	583	24	63 ³ / ₄	30 ⁵ / ₈	22	25	46 ³ / ₈	¶	613



RHEOSTAT

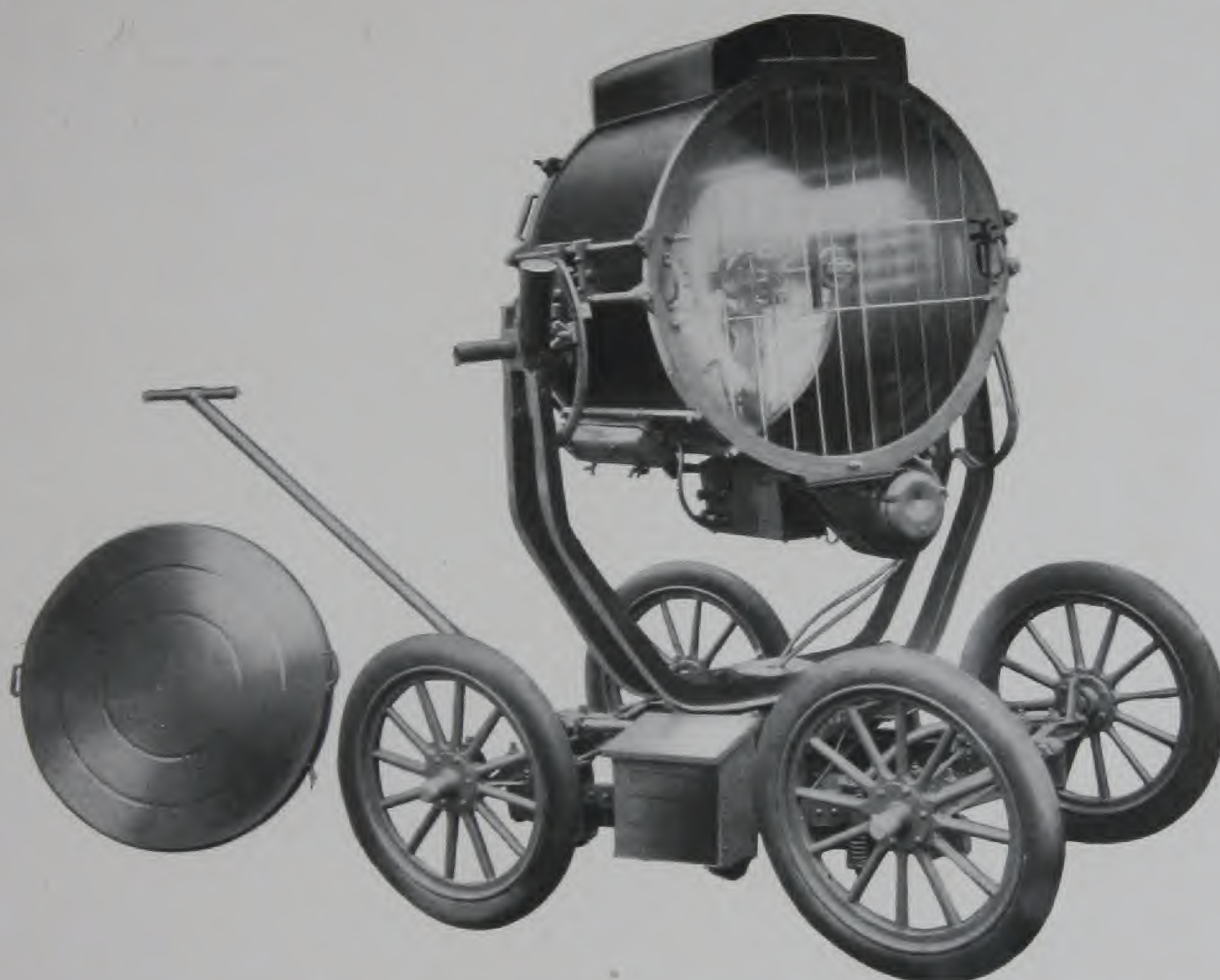
Size of Projector in In.	Cat. No. of Rheo.	DIMENSIONS IN INCHES	
		A	B
9	58723	9 ⁹ / ₁₆	6 ³ / ₄
13	58725	11 ⁷ / ₁₆	8 ⁵ / ₈
18	159544	15 ³ / ₁₆	12 ³ / ₄
24	159545	17 ¹ / ₁₆	14 ¹ / ₄

* Dimensions of 13- and 18-in. projectors are based on standard pedestal 22³/₄ in. high. Pedestals 26³/₄ and 30³/₄ in. high can be supplied on special order.

† Standard equipment including tool box, rheostat and 25 pairs of carbons.

¶ Controlled by handwheels, diameter of outer handwheel is 12 inches.

Commercial Uses for Searchlights



36-IN. HAND CONTROL HIGH INTENSITY G-E SEARCHLIGHT MOUNTED ON FOUR-WHEELED TRUCK FOR ARMY USE. THIS SEARCHLIGHT IS ARRANGED FOR AN ELEVATION OF THE BEAM TO 100 DEGREES, FOR ANTI-AIRCRAFT WORK, AND IS CONSTRUCTED PRINCIPALLY OF ALUMINUM, TO REDUCE THE WEIGHT



THE Closing Salvo at the Panama Pacific Exposition, taken at midnight December 4, 1915. At this instant the main lights were extinguished from the tower and the exposition was officially closed.
